Fluid intake replacement - developing a strategy for exercise

Cox, Gregory Roland

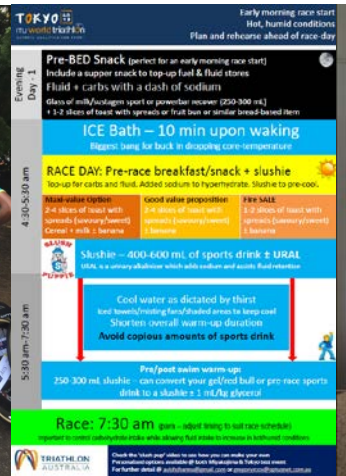
Keeping your Cool

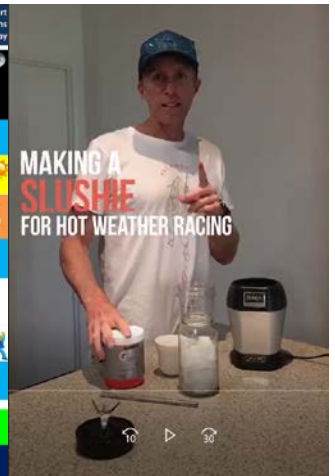
Fluid intake replacement – developing a strategy for exercise

Greg Cox – Sports Dietitian

Racing Tokyo

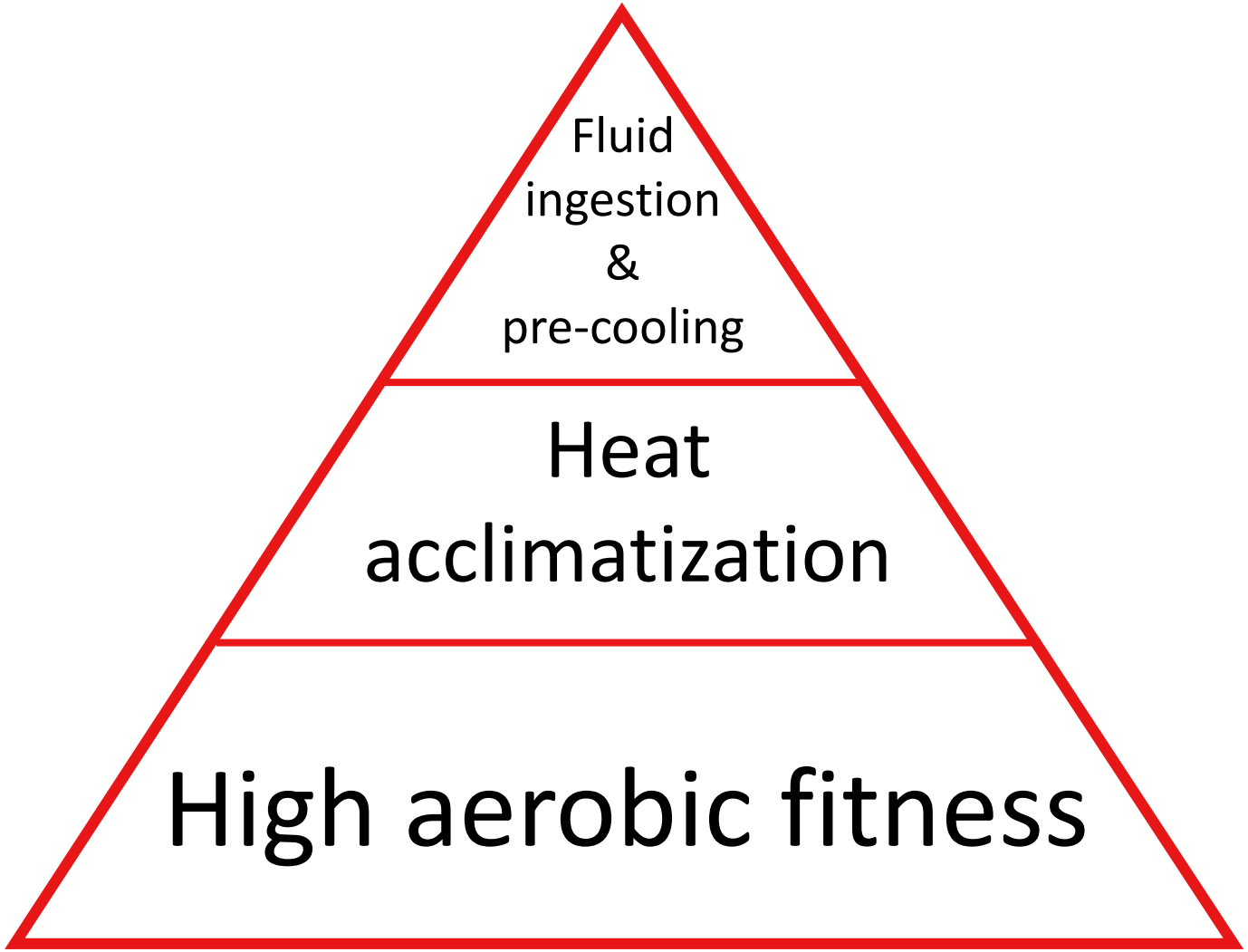
Competing in the heat, doesn't mean you can't compete well, but it increases your chances of competing poorly





BOND UNIVERSITY

Relative importance of hydration strategies



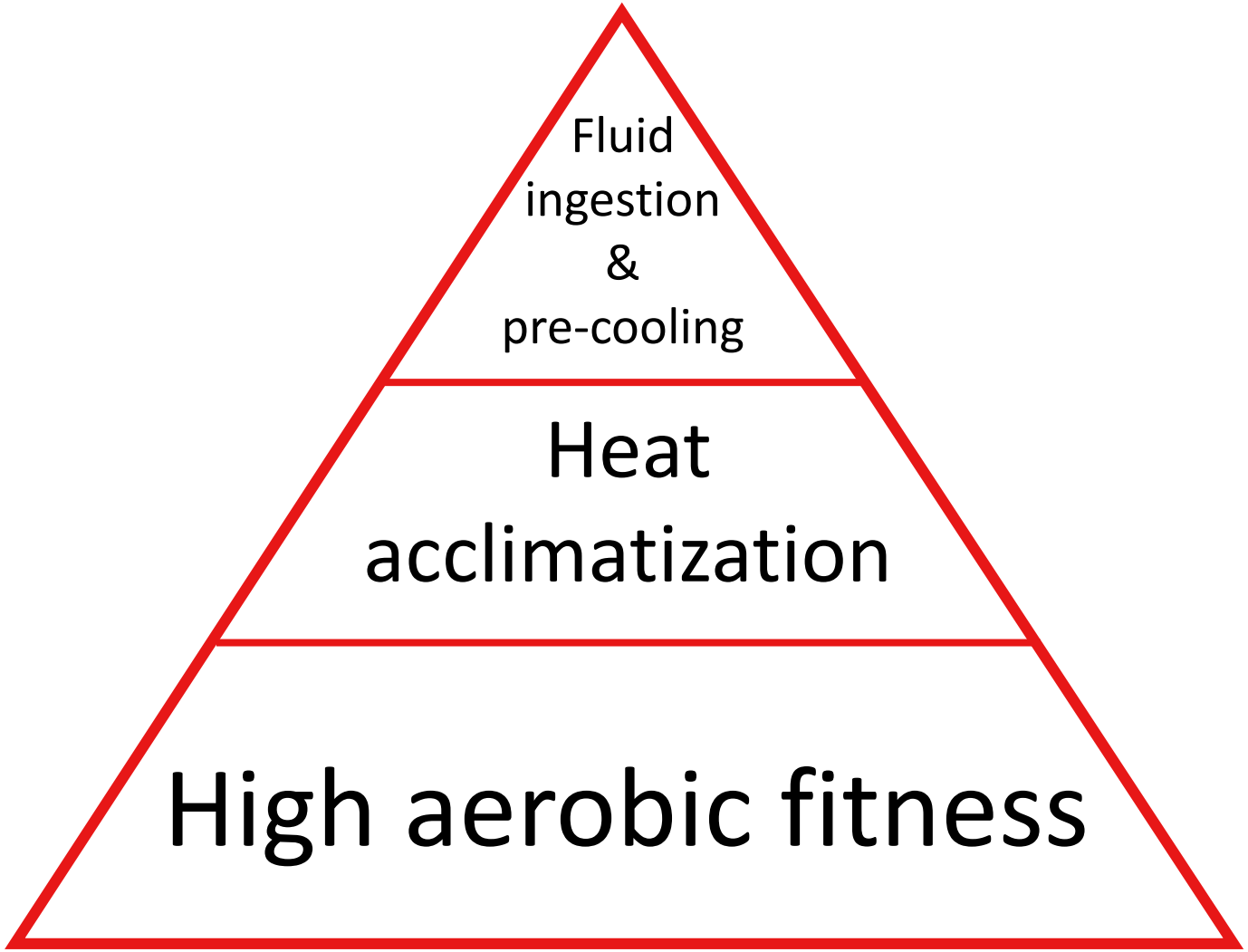
Four metrics:

- Temp lowered at the start of exercise
- The rise of temp during exercise
- Temp extended at the end of exercise to safe limits
- Endurance improved

Alhadad et al. Front Physiol. 10(71), 2019.

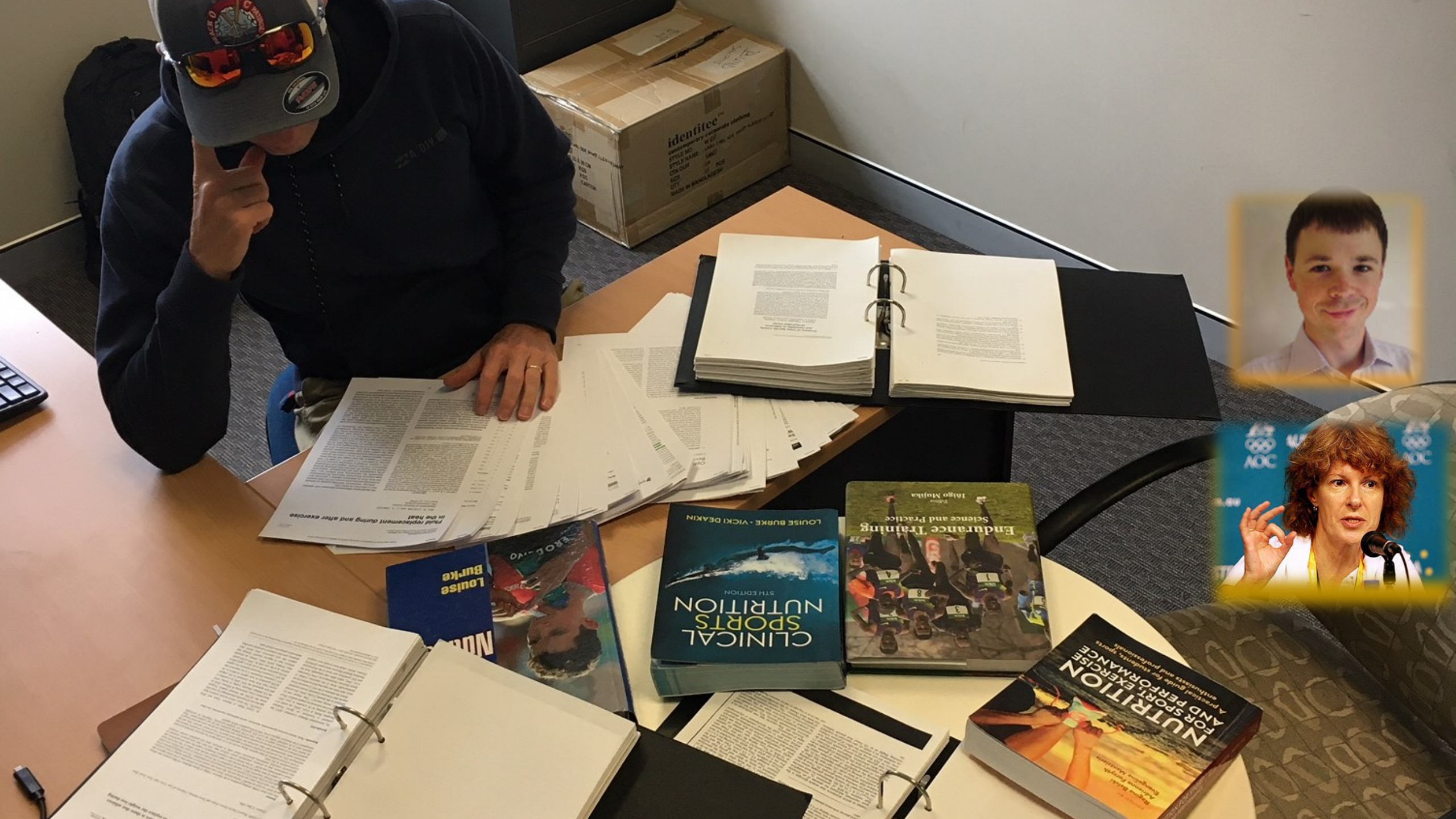
BOND UNIVERSITY

Relative importance of hydration strategies



Alhadad et al. Front Physiol. 10(71), 2019.

BOND UNIVERSITY


identitee
Louise Burke
CLINICAL SPORTS NUTRITION
5TH EDITION
LOUISE BURKE • VICKI DEAKIN
Endurance Training
Science and Practice
Iñigo Mujika
NUTRITION FOR SPORT, EXERCISE AND PERFORMANCE
A practical guide for students, sports enthusiasts and professionals
AOC

Interpreting hydration science for your client

BOND UNIVERSITY

How much should you drink?

It is clear that the perception of **thirst.. cannot be used** to provide complete restoration of water lost by sweating. Individuals must rely on strategies such as **monitoring BW loss** and ingesting volumes of fluid during exercise at a rate equal to that lost from sweating (ACSM, 1996 Position Stand: Exercise and Fluid Replacement)

Thirst (ad libitum drinking) should provide adequate stimulus for preventing excess dehydration and markedly reduce the risk of developing Exercise-Associated Hyponatremia

(Consensus statement of the 3rd International Exercise-Associated Hyponatremia Consensus Development Conference, Carlsbad, California, 2015)

The goal of drinking during exercise is to prevent excessive **(>2% BW loss from water deficit)** dehydration and excessive changes in electrolyte balance to avert compromised performance (ACSM, 2007 Position Stand: Exercise and Fluid Replacement)

Ideally athletes should drink sufficient fluids during exercise to replace sweat losses such that the total body fluid deficit is limited to < 2% BW

(ACSM, 2016 Position Stand: Nutrition and Athletic Performance)

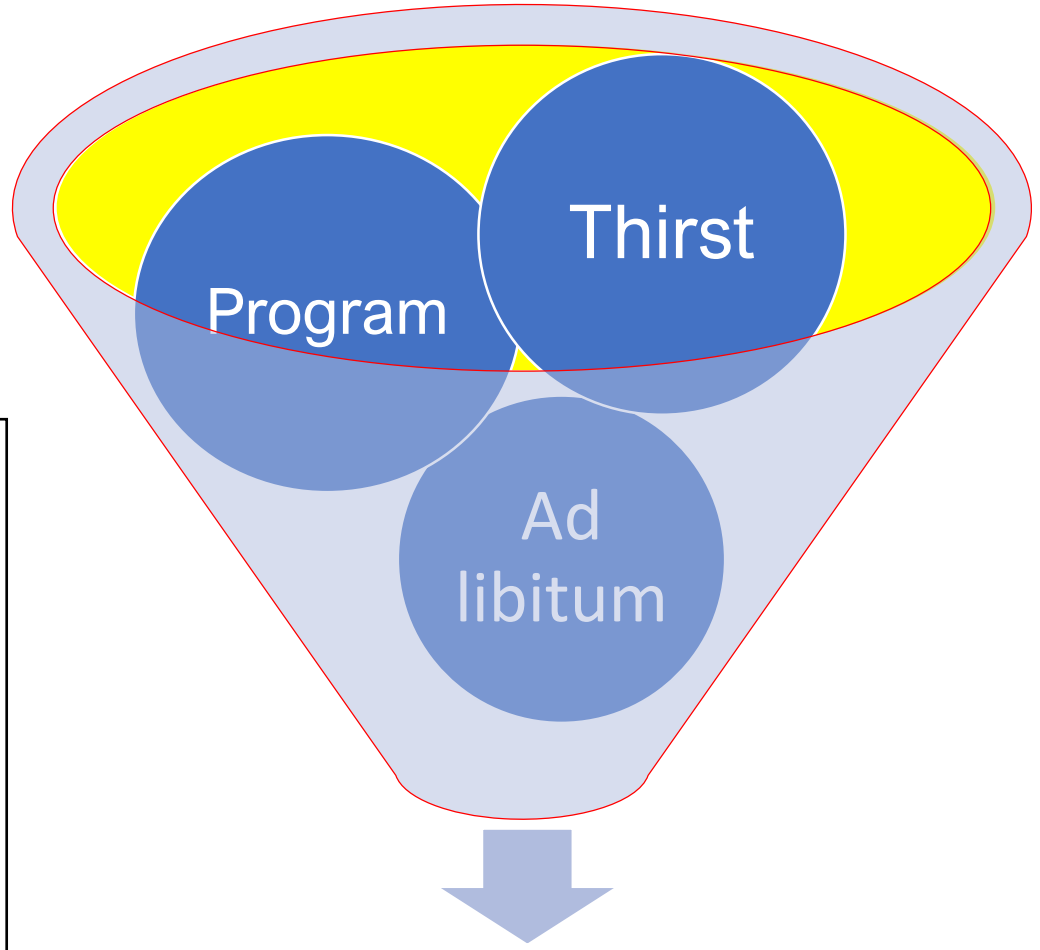
Definitions of NOTE for drinking purposes

Drinking to thirst - The use of the sensation of **thirst** as the only stimulus to **drink**

Ad libitum - is defined as the **consumption** of fluid **whenever**, and in **whatever** volume, desired

Programmed drinking - **drinking predetermined** amounts of fluid with the purpose of minimizing fluid losses

Kenefick. Sports Med. 48(Suppl 1):S31-37, 2018



Fluid intake strategy

BOND UNIVERSITY

When you get it wrong??

Murray et al. J Sport Rehabilitation.16:271-276, 2007.
Noakes et al. MSSE. 7:370-375, 1985.
Hoffman et al. Research Sports Med. 27(2):182-194, 2019.

Effect of hypohydration @3% BM loss

31°C 47%

Cyclists pair-matched & assigned to blinded or unblinded trials

Euhydrated trial ~ 2L
Hypohydrated trial ~ 200ml
Water @ 37°C

2h @ 50% Wpeak + ~15min TT

In all trials they had a small amount ~35ml of fluid orally

Funnell et al. JAP. 126:870-879, 2019.

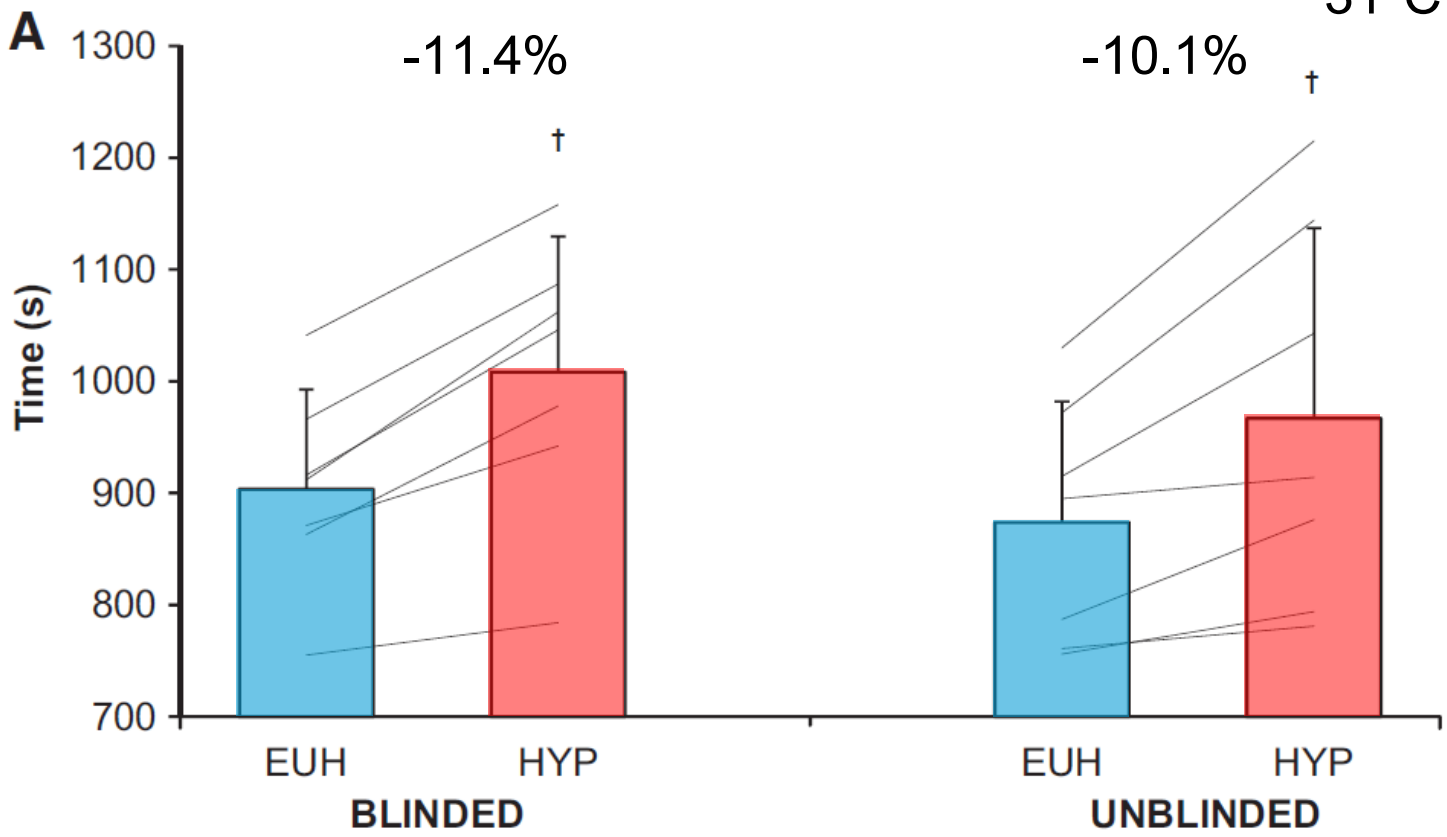
BOND UNIVERSITY

Effect of hypohydration @3% BM loss

31°C 47%

HYPOHYDRATED TRIALS

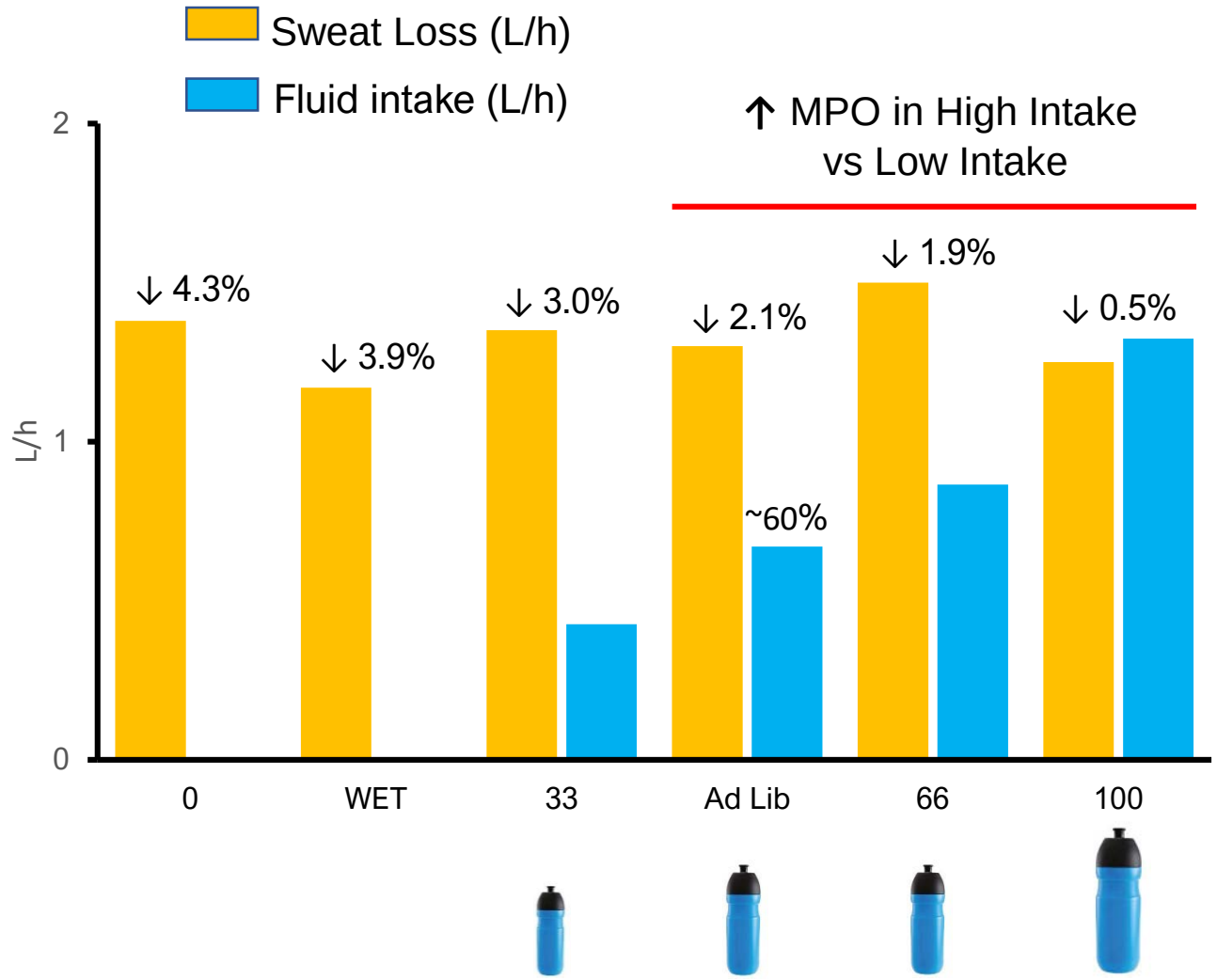
- ↓Plasma Volume
- ↑Plasma osmolality
- ↑Thirst sensation
- ↑Heart rate
- ↑GI temperate



Funnell et al. JAP. 126:870-879, 2019.

BOND UNIVERSITY

Drinking rate – 80km cycling TT



33°C 50%

Cyclists performed 6 x 80km TT's

AD LIBITUM trial 1, counterbalanced & randomised

Facing wind speed matched, water kept at room temp

Water & in all trials consumed 2 x CHO bars

Dugas et al. EJAP. 105:69-80, 2009.

BOND UNIVERSITY

What amount of body mass loss is tolerated

Really, no consensus
Suspect in HOT – likely 2-3%

IMPORTANT to ACCOUNT FOR:

- Starting hydration status
- Energy expenditure during endurance exercise – water production, substrate loss

As a practitioner need to focus on drinking behaviors and practices, consider athlete performance & implications, rather than scrutinize percent body mass change

Cheuvront & Montain. Exp Physiol. 102.9:1047-53, 2017.

BOND UNIVERSITY

Triggers for 'ad libitum' fluid intakes of athletes

Beverage Palatability

- Cold (0-10°C) or cool (10-22°C) ↑ intake ~50%
- Cool consumed slightly higher intake than cold
- Flavouring ↑ cooler & warmer beverage intake
- Addition of sodium ↑

Competition Day Dynamics

- Rules of competition
- Opportunity
- Access
- Amount of available fluids
- External cues from other athletes
- Distractions
- Tolerance
- Environmental conditions

Athlete Make-up

- Organised
- Over enthusiastic
- Absent mindedness
- Thirst

Sport

- Cultural elements of the sport
- Coaches/staff
- Other athletes
- Clubs, event organisers

- Source of other ingredients (e.g. carbohydrate, caffeine, electrolytes)

What influences fluid intake?

Drinks Stations

There are 19 Drinks Stations on the route of the 2019 Virgin Money London Marathon situated as follows:

Buxton Natural Mineral Water

Available at miles 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 and 25. Water is supplied in 250ml race bottles with a flip-top.

Lucozade Sport

Available at miles 7, 11, 15, 19 and 23.

Lucozade Sport Carbo Gel stations

Available at miles 14, 18 and 22.

Compostable cups

The Lucozade Sport Drinks Stations at miles 11 and 19 will offer drinks in compostable cups. Try drinking from a cup in training before Race Day.

Ooho sachets

At mile 23, Lucozade Sport will be provided in 25ml Ooho seaweed capsules. Oohos are edible and fully biodegradable, as well as vegan and allergen free.

Fluid intake behaviours of athletes

Bouite Stella et al. J Sports Med Physical Fitness. 57(11):1504-12, 2017.

289 Italian athletes

Regional, National and International

Feb-July Trieste, Italy (16±9oC, 62±6%)

Were asked to report:

- Type
- Quantity
- Quantity relative to available volume
- Pauses to drink
- Coaches encouragement

No encouragement:

- Lower fluid intakes

Higher reported fluid intakes:

- Number of pauses to drink
- Duration of exercise
- Coaches encouragement

BOND UNIVERSITY

Fluid intake behaviours of athletes

Judge et al J Strength Cond Res. 30(11):2972-78, 2016.

100 US college athletes

NCAA D1 University

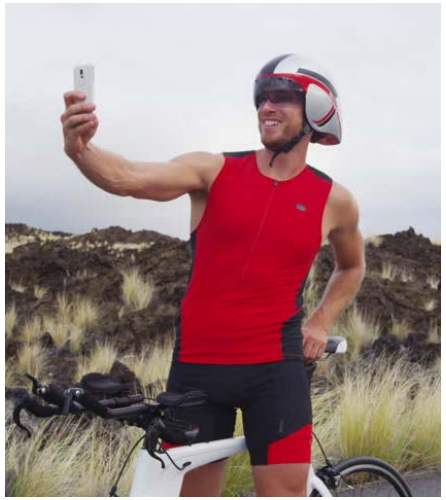
Summer football conditioning

Were asked to report:

- Sources of hydration information
- Perceived barriers to adequate fluid intake

Athletic Trainers

Physician



Key influencers – other athletes/trial & error

197 marathon runners completed an online survey regarding their beliefs about hydration and drinking behaviours

~60% of runners reported drinking to thirst

Most important influencers:

- experimenting (trial & error)
- advice from friends, coaches and race organisers
- recommendations from running clubs

Winger et al. BJSM. 45:646-649, 2011.

Tolerance – Stomach Comfort

24.5°C 30.6%

Runners performed 6 x 90-min runs (65% Vo_2 max), separated by 7-11 days

During run-1, subjects drank a glucose-electrolyte solution AD LIBITUM in 1-min every 10-min

During runs 2-6, subjects drank a volume of the solution every 10 min equal to their sweat losses

Lambert et al. IJSM. 29: 878-882, 2008

BOND UNIVERSITY

Tolerance – Stomach Comfort

24.5°C 30.6%

90min run
(65% VO2 max)

Variable	Running trial 1	2	3	4	5	6
Sweat rate (ml/h)	925 (128)	1007 (180)	984 (151)	974 (96)	955 (153)	927 (148)
Volume consumed (ml/90 min)	508* (476) p = 0.001	1246 (161)	1246 (161)	1246 (161)	1246 (161)	1246 (161)
Body mass loss (%)	1.4* (0.5) p = 0.0001	0.4 (0.2)	0.3 (0.2)	0.3 (0.2)	0.3 (0.3)	0.2 (0.3)
Final heart rate (bpm)	170 (7)	169 (8)	169 (8)	168 (9)	168 (10)	168 (8)
Final rectal temperature (°C)	38.4 (0.4)	–	38.0 (0.5)	38.1 (0.4)	38.2 (0.3)	–
Gastric emptying rate (% volume emptied)	N/A	81 (12)	N/A	N/A	N/A	82 (14)

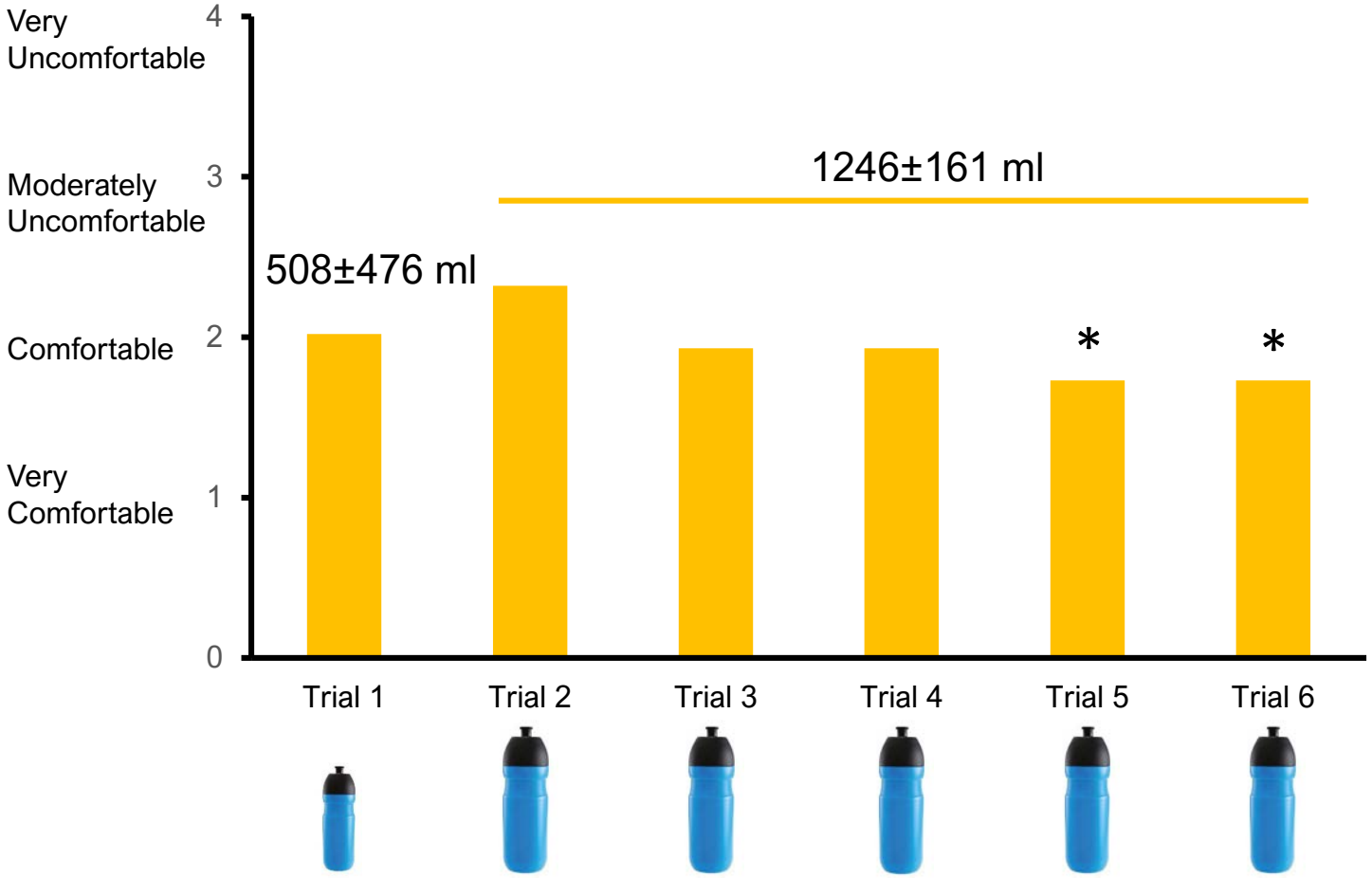
Values are mean (SD). Final rectal temperature data for trials 2 and 6 are excluded due to delays in obtaining these measurements following the gastric emptying procedure.
* Significantly different from all other experiments. Exact p values are noted for significant differences

Lambert et al. IJSM. 29: 878-882, 2008

BOND UNIVERSITY

Tolerance – Stomach Comfort

Gastric emptying rate did not differ between runs 2 and 6 (12.0±1.9 ml/min vs 12.3±2.3 ml/min)



24.5°C 30.6%

Stomach comfort improved in runs 5 & 6 despite no difference in gastric emptying

Lambert et al. IJSM. 29: 878-882, 2008

BOND UNIVERSITY

ME

Nathan's

Joey Chestnut:

72 hot dogs & buns in 10 minutes

14 | 2018 June

True Stomach Expansion Takes Time

The single largest mistake that amateur competitive eaters make when first starting out is attempting too large of a food challenge too soon in their career. No matter what recreational

0

Keep Reading »

14 | 2018 June

How To Expand Your Stomach Using Food

In an attempt to become a better American football player, I gained over 100 pounds of body weight during high school between my junior and senior football seasons. It took

0

Keep Reading »

How To Expand Your Stomach Using Water

Even if you are training with low calorie fruits and vegetables such as cabbage or watermelon, there is an extremely high chance that you will be consuming a higher than

0

Keep Reading »

Expanding Your Stomach Using Food AND Water

There's always at least two totally different sides to every story, and typically the best solution is for both sides to compromise and meet in the middle. This philosophy applies

0

Keep Reading »

Sweat Loss

LOW HIGH

Temperature

Over zealous

Opportunity

Tolerance

Absentminded

Palatability

Distracted

Race logistics

Intensity

Hyperhydrated

LOW HIGH

Fluid intake

SLOW MARATHON RUNNER IN COOL CONDITIONS

Sweat Loss

LOW HIGH

Over zealous

Temperature

Opportunity

Tolerance

Absentminded

Palatability

Distracted

Poorly hydrated

Race logistics

Intensity

LOW HIGH

Fluid intake

ELITE TRIATHLETE RACING OLYMPIC DISTANCE IN HOT HUMID CONDITIONS

Framework for a fluid intake strategy

Will the athlete commence exercise well-hydrated?	Assess hydration status	Convenient Assessment
Is the exercise prolonged or intense?	Increase availability of palatable fluids	Create opportunity More focused fluid intake messages
Is the exercise being performed in hot/humid conditions?	Increase availability of palatable fluids	Cues from other athletes Train tolerance for higher fluid intakes
Will fluid be available throughout the event?	Understand event logistics for fluid intake	Create practical solutions aligned with the dynamics of the event
What are the athletes' risk factors?	High sweat rates, GI comfort Obsessive/Absent mindedness	Accommodate strategy accordingly
What are the athletes' fueling requirements?	Integrate fueling strategies into fluid intake	Manage intake of carbohydrate containing fluids

Adapted from: Belval et al. Nutrients. 11:1550, 2019.

BOND UNIVERSITY